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BIODIVERSITY AND
CONSERVATION IN THE ANDES:
INTRODUCTION^{1,2}

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The Andes presents us with a long list of outstanding features. The adjectives, only occasionally qualified, that have been used to describe this mountain range are: longest, highest, deepest, roughest, flattest, steepest, wettest, driest, warmest, coldest, richest, poorest, youngest, and oldest. How do we present the biodiversity and conservation of such a varied region in a single day?

The 54th Annual Systematics Symposium of the Missouri Botanical Garden, “Biodiversity and Conservation in the Andes,” made an attempt on 12–13 October 2007; however, with the nine papers published here as the symposium proceedings, we were only able to scratch the surface of the Andes. An understanding of the critical questions—what species exist where, why are they there, and where should conservation efforts be focused—is hampered by the scale and complexity that biodiversity displays in the

Andes; these are the same qualities that make the area so fascinating. We present here a series of interesting papers that will serve as inspiration for the development of further hypotheses, questions, and research on the subject of biodiversity and conservation in the Andes, which in turn, we hope, will lead to the implementation of successful conservation plans in the area.

The Andes has an extremely varied landscape with a diversity of geological features that developed in slow motion or rapid jumps over millions of years, as presented by Alan Graham (Missouri Botanical Garden) in the first morning lecture. On a geological timescale, the diverse and highly endemic páramo vegetation came into existence only recently (3.5 million years ago [Ma]). The combination of slow lift and violent volcanism and, consequently, young and old substrates often in close proximity, as well as the

¹ This and the following nine papers are the proceedings of the 54th Annual Systematics Symposium of the Missouri Botanical Garden, “Biodiversity and Conservation in the Andes.” The symposium was held 12–13 October 2007 at the Missouri Botanical Garden in St. Louis, Missouri, U.S.A. Peter Jørgensen served as editor of the proceedings.

² This was the 52nd Missouri Botanical Garden Annual Systematics Symposium to be supported by a grant from the National Science Foundation (grant DEB-0515933). Many persons from the Missouri Botanical Garden staff contributed to a successful and memorable day. Peter Raven, Olga Martha Montiel, and Iván Jiménez helped to find the speakers; Mick Richardson was responsible for the program and the smooth running of the symposium; Mary McNamara, Sandy Lopez, and Mary Merello helped with registration; Zubin Chandra (Information Technology) and William Guy (Facilities Support) provided assistance with computers and projectors; Mateo Unda put together the coffee break slide shows; Barbara Alongi made the program illustration; and Victoria C. Hollowell, Beth Parada, Allison Brock, and Tammy Charron (Missouri Botanical Garden Press) were responsible for the publication of the symposium proceedings. I also want to thank the speakers and reviewers for making this series of most interesting papers available—an important step in reaching a better understanding and ultimately a better management of the biodiversity of the Andes.

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separations that are created by mountains and valleys, makes for a dynamic landscape on many scales and along numerous gradients that are immensely important for our understanding of biodiversity and conservation.

The Andes have created the driest (the Atacama Desert) and wettest (the Chocó rainforests) places on earth. The Atacama has been dry for more than 10 million years, while the Altiplano, just east of it, has undergone cycles of dry and wet periods as Christa Placzek (Purdue University) and her collaborators indicated in the second talk. It is fascinating that it never rains in northern Chile, while the salt flats of the nearby Altiplano have had a fluctuating precipitation regime for thousands of years linked to the El Niño–Southern Oscillation (ENSO) phenomenon.

Our knowledge of phylogeny and distribution, particularly in the Andes, is limited for many clades. One exception is the birds, and there are enough species to potentially reach a general notion that reflects both mechanistic ecological and historical evolutionary theory. Jon Fjeldså (University of Copenhagen) and collaborator did just that in the last morning session. They concluded that the upper forest limit plays a very important role in the diversification process, while small climatically stable areas near old human settlements have accumulated particularly high numbers of endemic birds.

Valleys, rivers, and ridges—are they all equally important as barriers for the distribution, isolation, and evolution of species? We include in these proceedings an invited paper by Jason Weir (University of Chicago), who was not able to participate in the symposium. In his paper, he evaluates high-endemism areas as useful conservation units, using genetic and phylogenetic techniques on both inter- and intra-specific variation. Lowland barriers were found to display the highest level of genetic differentiation, whereas above-tree-line barriers show less variation. Conservation recommendations were to place special emphasis on endemism areas separated by lowland barriers and deep interandean river valleys.

Moss spores float on the air and can cross barriers with an ease unlike vascular plants and even birds; they therefore are not governed by the same rules. Steven Churchill (Missouri Botanical Garden) wrote the second invited paper about moss diversity in the Andes. The group has traditionally been overdescribed, and many names have recently been reduced to synonymy. Endemism is still high and total richness

appears to be greatest at elevations of 2500–3000 m. In general, mosses contradict the usual negative relationship between latitude and species richness, but the narrow strip of Andean highlands and cloud forests harbors enough species to counteract the general tendency.

The Andean landscape has a nearly infinite amount of spatial barriers and provides ample opportunities for allopatric and sympatric speciation, but these barriers do not work with the same efficiency in time and space or for different taxonomic groups. A hummingbird-pollinated plant group is the subject of the paper by Lena Struwe (Rutgers University) and collaborators. Using newly developed software called Spatial Evolutionary and Ecological Vicariance Analysis (SEEVA), the evolutionary history and geography of the group are teased apart.

Why are there so many species in the tropics? This is a question that has occupied ecologists for several decades. Numerous hypotheses have been proposed, and few believe that there is a single explanation for the patterns that we detect. Trisha Distler (lecture presented by Iván Jiménez, both from the Missouri Botanical Garden) and collaborators tested the relative importance of the species-energy, spatial heterogeneity, and regional hypothesis as determinants in models that predict plant richness across large areas of South and Central America, using a large data set of collection data.

The Andes is one of the world's cradles of civilization; the Tiwanaku, the Inca, and many other groups were living in well-structured societies throughout the Andes long before the Spanish colonization. Kenneth Young (University of Texas) discussed the impact humans have had on biodiversity in the past and will continue to have in the future, with a focus on climatic changes in this region where large areas of the landscape matrix are devoted to agriculture.

Conservation of biodiversity without science is impossible, but how is scientific knowledge used in conservation? Carolina Murcia and Gustavo Kattan (Fundación EcoAndina) outlined a process where communication between the stakeholders is critical. It will be crucial to establish dynamic triangles of park managers, scientists, and conservation nongovernmental organizations, to encourage their cooperation so that scientific results can be quickly and efficiently applied in the field, and to secure that we all do the best possible job at conserving the biodiversity of the Andes.